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Hattori

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(54) **IMAGE FORMING DEVICE HAVING A CLEANING MEMBER FOR CLEANING AN IMAGE FORMATION SURFACE**

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(51) **Int. Cl.**
G03G 21/00 (2006.01)

(52) **U.S. Cl.** **399/98**; 399/99

(58) **Field of Classification Search** 399/98, 399/99, 388, 401, 402, 406, 381
See application file for complete search history.

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(57) **ABSTRACT**

An image forming device includes an image forming section, a plurality of recording-medium supply units, a transportation guide forming a plurality of transportation paths, a full-width cleaning member, a plurality of recording-medium separating members, and at least one partial cleaning member provided for each recording-medium separating member. The plurality of transportation paths joins together to provide a single main transportation path reaching the image forming section. The full-width cleaning member is disposed in the single main transportation path. The full-width cleaning member has a full-width cleaning portion wider than a recording medium. Each partial cleaning member has a partial cleaning portion wider than is the corresponding recording-medium separating member.

14 Claims, 4 Drawing Sheets

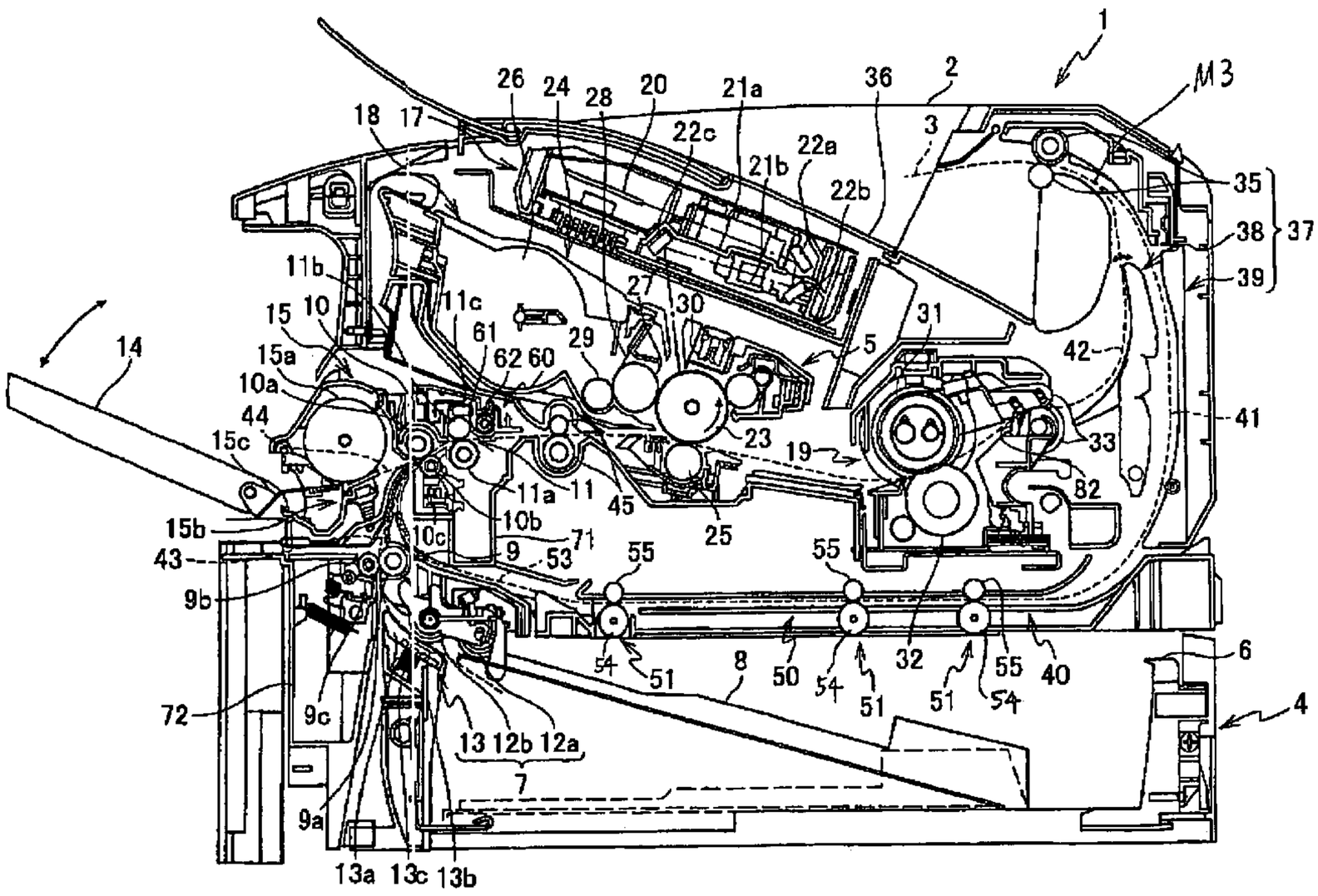
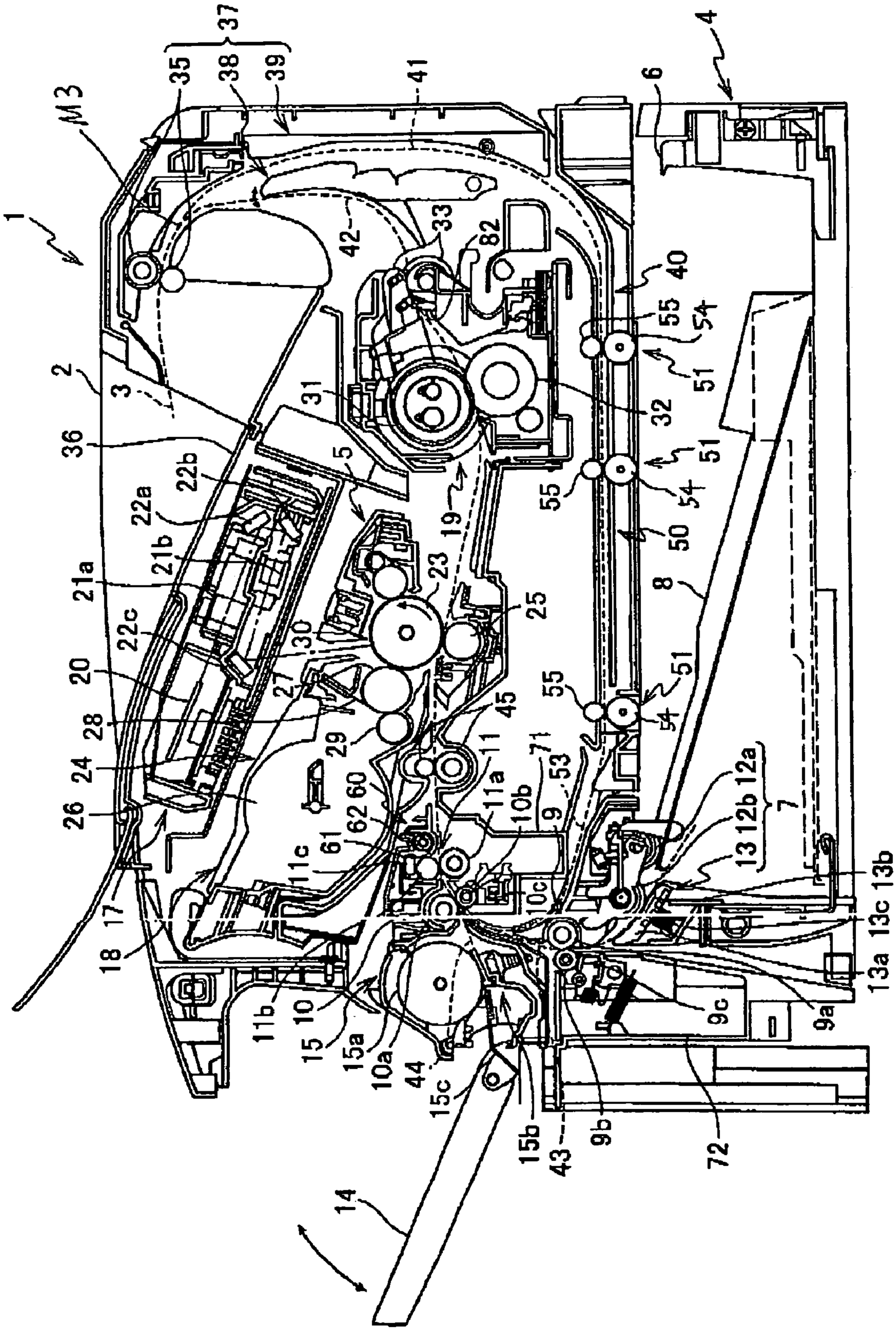


FIG.1


M3
1
2
3
35
37
38
39
41
4
6
42
33
82
40
55
54
51
36
31
32
5
22b
22a
21b
21a
22c
19
23
25
50
8
20
30
27
28
29
45
11
71
24
26
60
62
61
11a
10b
53
9
12a
12b
13
7
11c
10c
13b
13c
13a
17
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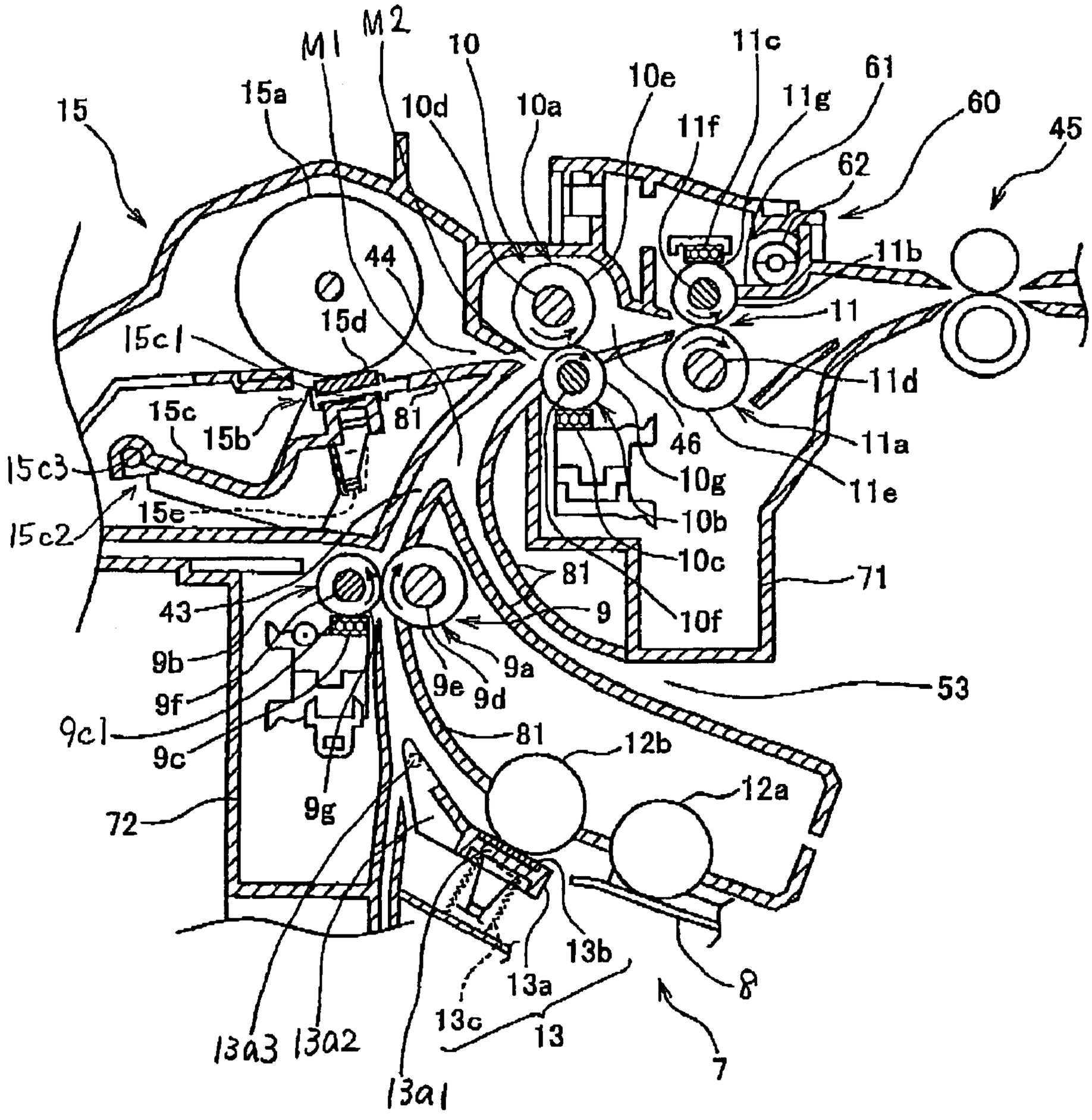
15
15a
10a
44
15c
9c
9a
9b
15b
43
72
14

FIG.2


M1
M2
10
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15a
10d
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11g
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11b
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11a
11e
44
15d
15c1
15c
15b
81
15c3
15e
15c2
46
10g
10b
10c
10f
71
81
43
9
9b
9f
9c1
9c
9g
72
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13a2
13a1

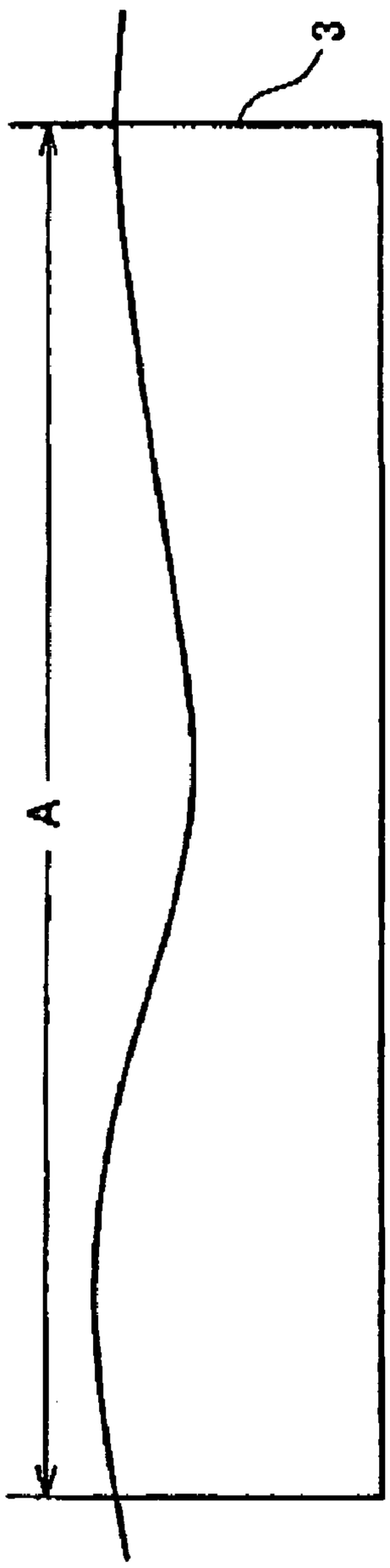

FIG.3(a)

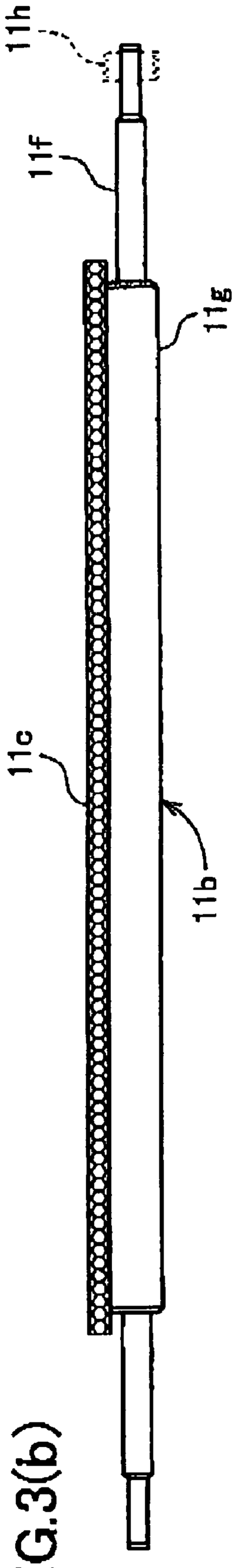

FIG.3(b)

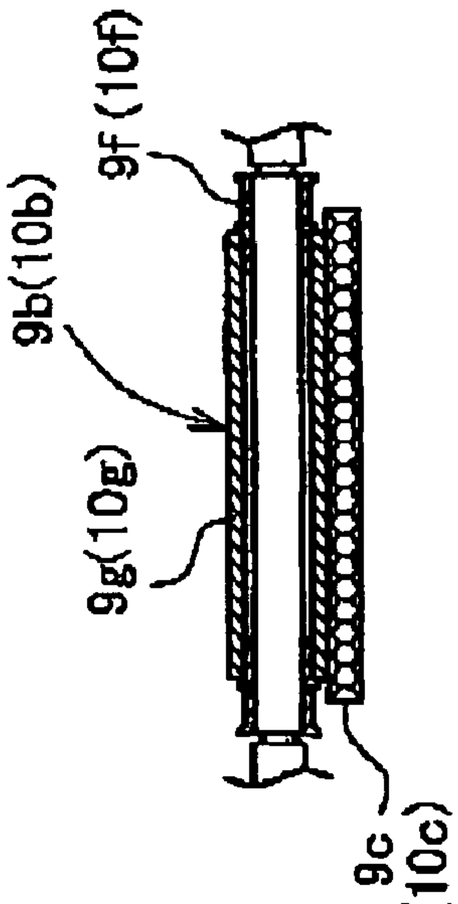

FIG.3(c)

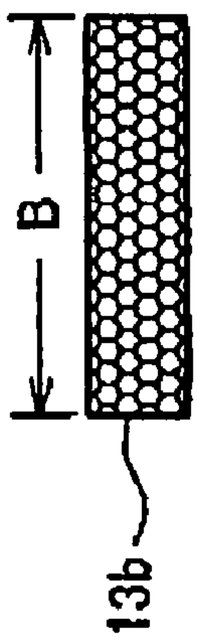

FIG.3(d)

FIG.4

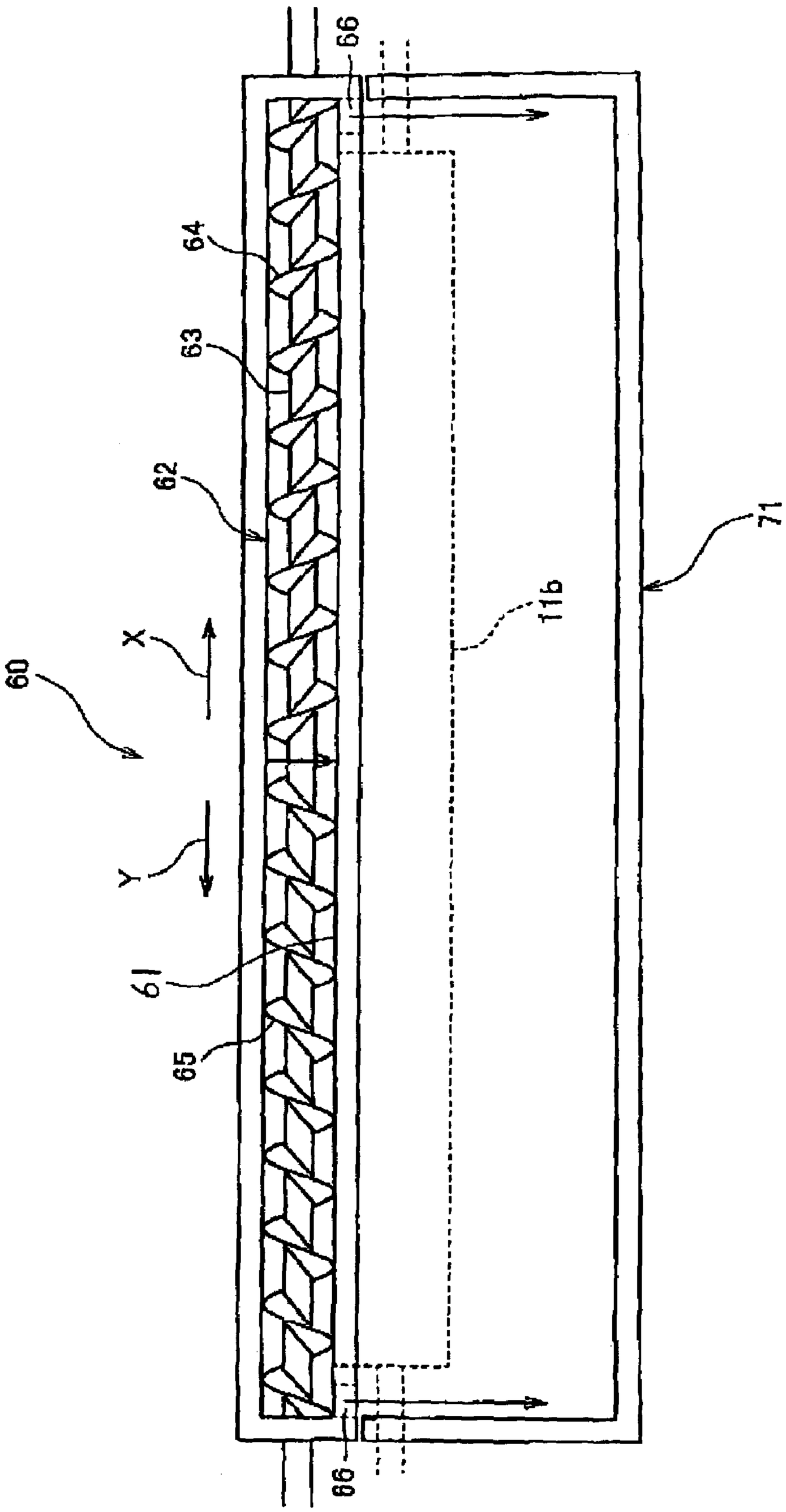

IMAGE FORMING DEVICE HAVING A CLEANING MEMBER FOR CLEANING AN IMAGE FORMATION SURFACE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image forming device such as a laser printer.

2. Description of Related Art

An image forming device such as a laser printer is usually provided with a paper feed mechanism for feeding paper and an image forming mechanism for forming an image on the fed paper.

The paper feed mechanism is provided with a paper feed tray in which paper is stacked in a pile, and a paper feed roller and a paper feed pad disposed above one end of the paper feed tray and disposed to confront each other. Paper at the top of the paper feed tray is pinched between the paper feed roller and the paper feed pad by rotation of the paper feed roller, and is fed one sheet at a time.

The image forming mechanism is provided with a photosensitive drum and, around the photosensitive drum, a charging device, a scanner device, a developing roller, and a transfer roller, in that order following the direction of rotation of the photosensitive drum. As the photosensitive drum rotates, the surface of the photosensitive drum is first uniformly charged by the charging device, then exposed by high-speed laser beam scan from the scanner device, and an electrostatic latent image is formed based on predetermined image data. Next, through rotation of the developing roller, toner held on the developing roller is supplied to the electrostatic latent image formed on the surface of the photosensitive drum and held selectively, whereby a visible image is formed. Then, while paper fed from the paper feed mechanism passes between the photosensitive drum and the transfer roller, the visible image held on the surface of the photosensitive drum is transferred to the paper, thereby forming a predetermined image on the paper.

In the above-described image forming device, since paper is fed one sheet at a time while being pinched between the paper feed roller and the separation pad, paper dust may be generated on the paper due to friction between the paper feed roller and the separation pad. In addition, foreign matter such as paper dust may be generated over the entirety of the paper when the paper is cut. If such paper dust mixes with the toner in the image forming mechanism, a problem of image quality degradation will occur.

Accordingly, for example, Japanese patent-application publication No. 2003-81476 discloses a device in which a paper dust removing roller of approximately the same width as the separation pad, and a paper dust removing roller of approximately the same width as the paper, are disposed downstream of the paper feed roller in the paper transportation direction. Thus, paper dust generated on paper can be eliminated in a well-balanced manner before the paper is transported to the image forming mechanism.

SUMMARY OF THE INVENTION

However, in the device disclosed in Japanese patent-application publication No. 2003-81476, the dust removing rollers of approximately the same width as the paper are not provided for all paper feed paths, resulting in a problem of failing to eliminate paper dust generated on paper in a well-balanced manner for all the paper used.

In view of the above-described drawbacks, it is an objective of the present invention to provide an image forming device that can eliminate foreign matter effectively, and can form high-quality images, for paper transported from any paper feed path in the image forming device.

In order to attain the above and other objects, the present invention provides an image forming device. An image forming device includes an image forming section, a plurality of recording-medium supply units, a transportation guide, a full-width cleaning member, a plurality of recording-medium separating members, and at least one partial cleaning member provided for each recording-medium separating member. The image forming section forms an image on an image formation surface of a recording medium. The recording medium has a width in a widthwise direction orthogonal to a recording-medium transportation direction. Each of the plurality of recording-medium supply units supplies the image forming section with the recoding medium. The transportation guide forms a plurality of transportation paths. Each transportation path connects a corresponding one of the plurality of recording-medium supply units to the image forming section. The recording medium is transported from each recording-medium supply unit to the image forming section in the recording-medium transportation direction. The plurality of transportation paths joins together to provide a single main transportation path reaching the image forming section. The full-width cleaning member is disposed in the single main transportation path. The full-width cleaning member is contactable with the image formation surface of the recording medium. The full-width cleaning member has a full-width cleaning portion for removing foreign matter adhering to the image formation surface of the recording medium. The full-width cleaning portion has a first width greater than the width of the recording medium in the widthwise direction. Each of the plurality of recording-medium separating members is disposed at a position, in each of the plurality of transportation paths, between a corresponding recording-medium supply unit and the full-width cleaning member. Each recording-medium separating member is contactable with one surface of the recording medium, thereby separating only one sheet of the recording medium to be transported downstream. Each recording-medium separating member has a second width in the widthwise direction smaller than the width of the recording medium. The at least one partial cleaning member is provided for each recording-medium separating member. The at least one partial cleaning member is disposed at a position, in a corresponding transportation path, between a corresponding recording-medium separating member and the image forming section. Each partial cleaning member is contactable with the one surface of the recording medium. Each partial cleaning member has a partial cleaning portion for removing foreign matter adhering to the one surface of the recording medium. The partial cleaning portion has a third width greater than the second width of the corresponding recording-medium separating member.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the invention will become more apparent from reading the following description of the preferred embodiments taken in connection with the accompanying drawings in which:

FIG. **1** is a side cross-sectional view showing principal parts of a laser printer according to an embodiment of the present invention;

FIG. **2** is an enlarged side cross-sectional view showing paper feed transportation paths of the laser printer shown in FIG. **1**;

FIG. **3**(*a*) is a plan view of paper used in the laser printer shown in FIG. **1**;

FIG. **3**(*b*) is a cross-sectional view of a third paper dust removing roller in the laser printer shown in FIG. **1**;

FIG. **3**(*c*) is a cross-sectional view of a first paper dust removing roller and a second paper dust removing roller in the laser printer shown in FIG. **1**;

FIG. **3**(*d*) is a cross-sectional view of a pad member in the laser printer shown in FIG. **1**; and

FIG. **4** is a side view of a paper dust transportation section of the laser printer shown in FIG. **1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An image forming device according to a preferred embodiment of the present invention will be described while referring to the accompanying drawings.

As shown in FIG. **1**, a laser printer **1** forms an image by electrophotography, and is provided with, in a main casing **2**, a paper supply cassette **4** for feeding paper **3** as a recording medium, an image forming section **5** for forming predetermined images on the fed paper **3**, and so forth.

The paper supply cassette **4** is disposed, in the bottom area within the main casing **2**. The paper supply cassette **4** includes a removable paper feed tray **6**, a paper feed mechanism section **7** fitted to one end of the paper feed tray **6**, a paper pressure plate **8** fitted inside the paper feed tray **6**, a first transportation section **9** located downstream in a paper transportation direction with respect to the paper feed mechanism section **7** (hereinafter, "upstream in the paper transportation direction" and "downstream in the paper transportation direction" may be referred to simply as "upstream" and "downstream"), a second transportation section **10** and a third transportation section **11**, and registration rollers **45** located downstream in the paper transportation direction with respect to the first transportation section **9** and the second transportation section **10**.

The paper feed tray **6** is box-shaped and has a top that can be opened to allow the paper **3** to be accommodated. The paper feed tray **6** can be inserted into and removed from the bottom part of the main casing **2** horizontally.

As shown in FIGS. **1** and **2**, the paper feed mechanism section **7** includes a pickup roller **12***a* that picks up the paper **3** on the paper pressure plate **8**, a separation roller **12***b* that has a surface with a higher coefficient of friction than a coefficient of friction of a pad member **13***b* described later, and a separation pad **13** confronting the separation roller **12***b*. The separation pad **13** includes a support frame **13***a*, the pad member **13***b*, and a spring **13***c*.

The pickup roller **12***a* picks up the paper **3** on the paper pressure plate **8**, and feeds the paper **3** to the separation roller **12***b* side in a first transportation path **43**.

The separation roller **12***b* is positioned in the first transportation path **43** so as to pinch the paper **3** picked up by the pickup roller **12***a* between the separation roller **12***b* and the pad member **13***b*, such that one sheet of the paper **3** is transported downstream in the paper transportation direction.

As shown in FIG. **2**, the support frame **13***a* includes a flat plate-shaped member **13***a***1** and a support member **13***a***2**, and is formed as a member with an L-shaped cross section. The flat plate-shaped member **13***a***1** is disposed below the separation roller **12***b* and confronts the separation roller **12***b*. The support member **13***a***2** is connected to one end of the flat plate-shaped member **13***a***1**, and is formed to bend downward approximately at a right-angle from the one end of the flat plate-shaped member **13***a***1**. An upper end portion **13***a***3** of the support member **13***a***2** is pivotally supported to a casing (not shown), such that the separation pad **13** can be pivotally moved. The pad member **13***b* is inset in a concave portion on the side of the flat plate-shaped member **13***a***1** that confronts the separation roller **12***b*. The spring **13***c* is disposed on the other side that is an opposite side to the separation roller **12***b*. The spring **13***c* urges the flat plate-shaped member **13***a***1**, such that the pad member **13***b* is pressed against the separation roller **12***b*.

As shown in FIG. **3**(*d*), the pad member **13***b* has an approximately rectangular plate shape and is formed from a urethane rubber or similar elastic member. A width B of the pad member **13***b* in the widthwise direction orthogonal to the paper transportation direction (hereinafter "width in the direction orthogonal to the paper transportation direction" may be referred to simply as "width") is smaller than a width A of the paper **3** shown in FIG. **3**(*a*). The width A is the maximum width of the paper **3** for which printing can be performed by the laser printer **1**. In other words, the pad member **13***b* has a width that provides contact with only the widthwise center part of the paper **3** for feeding the paper **3**.

As shown in FIG. **1**, the paper pressure plate **8** allows the paper **3** to be stacked in a pile. The paper pressure plate **8** is pivotally supported about the farther end from the pickup roller **12***a*, enabling its nearer end to move up and down. The paper pressure plate **8** is raised by a pressure plate raising mechanism (not shown). At this time, topmost paper **3** contacts the pickup roller **12***a* and further raises the pickup roller **12***a*, and stops at a position at which a sensor (not shown) detects the pickup roller **12***a*. The pickup roller **12***a* is forced downward by a spring (not shown) and is pressed against the paper pressure plate **8**. Then the topmost paper **3** is picked up by the rotation of the pickup roller **12***a* and transported to the separation roller **12***b*. By being pinched between the separation roller **12***b* and the pad member **13***b*, the paper **3** is separated and fed one sheet at a time by the cooperative action of the separation roller **12***b* and the pad member **13***b*. The first transportation path **43** is formed by a transportation guide **81** between the paper feed mechanism section **7** and the image forming section **5**. The fed paper **3** is sent to the registration rollers **45** by the first transportation section **9**, the second transportation section **10**, and the third transportation section **11**, along the first transportation path **43**. The registration rollers **45** include a pair of rollers. The registration rollers **45** send the paper **3** to the image forming section **5** after predetermined registration of the paper **3**.

As shown in FIG. **1**, the image forming section **5** includes a scanner section **17**, a process section **18**, a fixing section **19**, and so forth.

The scanner section **17** is disposed in an upper area within the main casing **2**, and includes a laser emitting section (not shown), a polygonal mirror **20**, lenses **21***a* and **21***b*, reflecting mirrors **22***a* through **22***c*, and so forth. In the scanner section **17**, a laser beam based on predetermined image data emitted from the laser emitting section is irradiated through or reflected from the polygonal mirror **20**, the lens **21***a*, the reflecting mirrors **22***a* and **22***b*, the lens **21***b*, and the reflecting mirror **22***c*, in this order, as shown by the single-dot chain line, and is irradiated onto the surface of a photosensitive drum **23** of the process section **18** in a high-speed scan.

The process section **18** is positioned below the scanner section **17**, and is detachably mounted in the main casing **2**.

The process section **18** includes the photosensitive drum **23**, a developing cartridge **24**, a transfer roller **25**, and a scorotron-type charger **30**. The developing cartridge **24** is detachably mounted to the process section **18**, and includes a toner container **26**, a developing roller **27**, a thickness regulating blade **28**, a toner supply roller **29**, and so forth.

The toner container **26** is filled with positively charged, non-magnetic, single-component polymer toner. The toner is supplied to the developing roller **27** by the toner supply roller **29**, and is held on the developing roller **27** as a thin layer of a certain thickness by the scraping action of the thickness regulating blade **28**. The photosensitive drum **23** is positioned to confront the developing roller **27**, and is rotatable. The drum body of the photosensitive drum **23** is grounded, and is formed of a positively-charged photosensitive layer formed from polycarbonate or the like.

As the photosensitive drum **23** rotates in the direction indicated by the arrow, the surface of the photosensitive drum **23** is uniformly positively charged by the scorotron-type charger **30**, and is then exposed by a high-speed laser S beam scan by the scanner section **17**, and an electrostatic latent image is formed. Subsequently, when the photosensitive drum **23** is opposed to the developing roller **27**, the positively-charged toner held on the developing roller **27** is supplied to and selectively held by the electrostatic latent image formed on the surface of the photosensitive drum **23**, that is, portions exposed by the laser beam and whose potential has fallen on the surface of the uniformly positively-charged photosensitive drum **23**. In this way, the image becomes visible and transfer developing can be performed.

The transfer roller **25** is located below and confronts the photosensitive drum **23**. The transfer roller **25** has a roller of conductive rubber material covering a metallic roller shaft, and has a predetermined transfer bias applied with respect to the photosensitive drum **23**. Thus, the visible image held on the photosensitive drum **23** is transferred to the paper **3** while the paper **3** passes between the photosensitive drum **23** and the transfer roller **25**. Then the paper **3** onto which the visible image has been transferred is transported to the fixing section **19**.

The fixing section **19** is located downstream of the process section **18**. The fixing section **19** includes a heating roller **31**, a pressure roller **32** that applies pressure to the heating roller **31**, and a transport rollers **33** located downstream of the heating roller **31** and the pressure roller **32**.

The heating roller **31** is metallic and is provided with a halogen lamp for heating. While the paper **3** passes between the heating roller **31** and the pressure roller **32**, the heating roller **31** heat-fixes the toner transferred onto the paper **3** in the process section **18**. Then the paper **3** is transported to the paper discharge rollers **35** by the transport rollers **33** of the fixing section **19**. After being transported to the paper discharge rollers **35**, the paper **3** is discharged onto a discharge tray **36**.

A paper sensor **82** is disposed between the heating roller **31** and the transport rollers **33**. At the time of reverse transportation of the paper **3** described later, when the rear end of the paper **3** is detected by the paper sensor **82**, the paper discharge rollers **35** are switched from forward rotation to reverse rotation at predetermined timing after the detection timing.

With the laser printer **1**, the developing roller **27** recovers residual toner remaining on the surface of the photosensitive drum **23** after the transfer roller **25** has performed transfer. That is, the residual toner is recovered by a so-called cleanerless developing method since the residual toner is recovered by the cleanerless developing method, there is no need for a special member such as a blade for storing removing residual toner, or for a storage section for waste toner, thereby simplifying the device configuration.

The laser printer **1** is provided with the reverse mechanism **37** that reverses the paper **3**, and a retransportation tray **40** that retransports the paper **3** to the image forming section **5** in order to form images on both sides of the paper **3**. The reverse mechanism **37** includes the paper discharge rollers **35**, a flapper **38**, and a reverse guide **39**. The reverse mechanism **37** and the retransportation tray **40** may be integrated and detachably mounted to the main casing **2** as a unit.

The paper discharge rollers **35** include a pair of rollers, and enable switching between forward and reverse rotation. As described above, when the paper **3** is to be discharged onto the discharge tray **36**, the paper discharge rollers **35** rotate in the forward direction and transport the paper **3** in the paper transportation direction. However, when the paper **3** is to be reversed and transported in the reverse direction, the paper discharge rollers **35** rotate in the reverse direction.

The reverse guide **39** forms a reverse transportation path **41** in a vertical direction together with the flapper **38** so that the paper **3** can be transported from the paper discharge rollers **35** to the retransportation tray **40** located below the image forming section **5**. The upstream end of the reverse transportation path **41** is located near the paper discharge rollers **35** and the downstream end thereof is located near the retransportation tray **40**. In the reverse transportation path, the paper **3** is transported with its widthwise center as a reference (instead of transporting the paper **3** with its widthwise end as a reference), which is so-called center registration feed.

The flapper **38** is provided near a junction position M3 that is a junction of a paper discharge path **42** and the reverse transportation path **41**. The flapper **38** can be pivotally moved. More specifically, the flapper **38** can switch the transportation direction of the paper **3** reversed by the paper discharge rollers **35**, from the direction toward the paper discharge rollers **35** to the direction toward the retransportation tray **40** in accordance with excitation or non-excitation of a solenoid (not shown).

The retransportation tray **40** is approximately plate-shaped, and is disposed approximately horizontally above the paper feed tray **6**. The upstream end of the retransportation tray **40** is located near the rear end of the reverse transportation path **41**, and the downstream end is located below the registration rollers **45**.

The reverse mechanism **37** is operated as described below. When the paper **3** with an image formed on one side is fed from the paper discharge path **42** to the paper discharge rollers **35** by the transport rollers **33**, the paper discharge rollers **35** rotate forward while pinching the paper **3** and transport the paper **3** initially toward the outside (the discharge tray **36** side). Subsequently, when a greater part of the paper **3** has been fed toward the outside and the rear end of the paper **3** is between the paper discharge rollers **35**, forward rotation is halted. Next, the paper discharge rollers **35** rotate in the reverse direction, and the flapper **38** switches the transportation direction so that the paper **3** is transported to the reverse transportation path **41**. Thus, the paper **3** is transported to the reverse transportation path **41** with its lengthwise direction reversed. The timing for switchover of the paper discharge rollers **35** from forward to reverse rotation is controlled so as to be a predetermined time after the rear end of the paper **3** is detected by the paper sensor **82**, as described above. When transportation of the paper **3** ends,

the flapper **38** is switched to its original state, that is, the state in which the paper **3** fed from the transport rollers **33** is fed to the paper discharge rollers **35**. Next, the paper **3** transported in the reverse direction to the reverse transportation path **41** is further transported to the retransportation tray **40**. Then, the paper **3** is transported upward from the retransportation tray **40**, and transported to the registration rollers **45**. The paper **3** transported to the registration rollers **45** has predetermined registration applied again in the reversed state, and is then sent toward the image forming section **5**, by which a predetermined image is formed on the reverse side of the paper **3**.

The retransportation tray **40** includes a tray body **50** and oblique rollers **51**. The tray body **50** has an approximately rectangular plate shape, and is disposed approximately horizontally above the paper feed tray **6**. The upstream end of the tray body **50** is connected to the reverse guide **39**. The downstream end of the tray body **50** is connected to a retransportation path **53** that is connected to the first transportation path **43**, in order to guide the paper **3** from the tray body **50** to the second transportation section **10**.

The three oblique rollers **51** are provided in the tray body **50** at predetermined intervals along the paper transportation direction for transporting the paper **3**. The paper **3** is transported while in contact with a reference plate (not shown).

Each oblique roller **51** is provided with an oblique drive roller **54** and an oblique follow roller **55**. The oblique drive roller **54** is located near the reference plate (not shown) disposed at one widthwise end of the tray body **50**. The axes of the oblique drive rollers **54** are positioned **5** in a direction approximately orthogonal to the paper transportation direction. The oblique follow roller **55** confronts the oblique drive roller **54** and sandwiches the paper **3** with the oblique drive roller **54**. The axes of the oblique follow rollers **55** are positioned such that the paper **3** is transported in a direction oblique with regard to the paper transport direction toward the reference plate.

The paper **3** sent from the reverse transportation path **41** to the tray body **50** is transported by the oblique rollers **51** via the retransportation path **53** while one widthwise edge of the paper **3** is in contact with the reference plate, and toward the image forming section **5**, with the front and back reversed. When the paper **3** is transported to the image forming section **5**, the rear surface thereof is brought into contact with the photosensitive drum **23**, the visible image is transferred and then fixed by the fixing section **19**, and the paper **3** is discharged to the discharge tray **36** with images formed on both sides.

As shown in FIG. **2**, the laser printer **1** is provided with the first transportation section **9**, the second transportation section **10**, and the third transportation section **11**, all positioned in the first transportation path **43**. With this construction, the laser printer **1** can remove, in a well-balanced manner, paper dust originally generated on the entire paper **3** when the paper **3** is cut and paper dust generated on the surface of the paper **3** due to friction between the pad member **13***b* and the separation roller **12***b* of the paper feed mechanism section **7**. Also, as shown in FIG. **4**, a paper dust transportation section **60** is provided to transport paper dust removed by the third transportation section **11** to a storage tank **71** described later.

The relationships among the transportation paths **43**, **44**, **46**, and **53** are described. The first transportation path **43**, the second transportation path **44**, the transportation path **46**, and the retransportation path **53** are formed by the transportation guide **81**. The first transportation path **43** is formed to pass through the paper feed mechanism section **7**, the first transportation section **9**, the second transportation section **10**, and the third transportation section **11**. The second transportation path **44** is formed to pass through the multi-purpose paper feed mechanism section **15**, the second transportation section **10**, and the third transportation section **11**. The retransportation path **53** joins or merges with the first transportation path **43** at a junction position M**1**. The first transportation path **43** and the second transportation path **44** joins with each other at a junction position M**2**. Thus, the first transportation path **43** and the second transportation path **44** overlaps in a section downstream of the junction position M**2**. The transportation path **46** is formed in the overlapped section between the junction position M**2** and the registration rollers **45**. In other words, the transportation path **46** is a part of the first transportation path **43** and the second transportation path **44**.

The first transportation section **9** is positioned downstream in the paper transportation direction with respect to the separation roller **12***b* of the paper feed mechanism section **7** at the forward portion of the first transportation path **43**. The first transportation section **9** is positioned at a predetermined distance from the separation roller **12***b* and further upstream than the junction position M**1** in the first transportation path **43**. The first transportation section **9** includes a first transportation roller **9***a* that transports the paper **3**, a first paper dust removing roller **9***b* confronting the same surface of the paper **3** as the surface confronting the separation pad **13**, and a first sponge member **9***c* positioned below the first paper dust removing roller **9***b*.

The first transportation roller **9***a* confronts the first transportation path **43** from the inner side. The first transportation roller **9***a* has a metallic roller shaft **9***d* covered with a rubber roller **9***e*, and is rotatable in the direction indicated by the arrow (clockwise direction in FIG. **2**) by the power transmitted from a motor (not shown).

The first paper dust removing roller **9***b* confronts the first transportation path **43** from the outer side. The first paper dust removing roller **9***b* has a metallic roller shaft **9***f* covered with a resin roller **9***g* whose surface is easily charged. The resin roller **9***g* is, for example, a roller of fluororesin or a roller with a fluororesin coated surface. As shown in FIG. **3**(*c*), the first paper dust removing roller **9***b* is positioned in an approximately center position with respect to the first transportation roller **9***a*, such that the first paper dust removing roller **9***b* overlaps the separation pad **13** in the paper transportation direction. Accordingly, the first paper dust removing roller **9***b* can contact the surface of the paper **3** that has contacted the pad member **13***b* (the image formation surface). More specifically, the first paper dust removing roller **9***b* can contact a part that has contacted the pad member **13***b* (the approximately center part). The width of the roller **9***g* of the first paper dust removing roller **9***b* is identical to the width of a roller **10***g* of a second paper dust removing roller **10***b* described later, but smaller than the width of a roller **11***g* of a third paper dust removing roller **11***b* described later, and slightly greater than the width B of the pad member **13***b*.

The first paper dust removing roller **9***b* is driven by the first transportation roller **9***a*. The first paper dust removing roller **9***b* is rotatable in the direction indicated by the arrow, that is, the same direction as the paper transportation direction in the part confronting the first transportation path **43** (counterclockwise direction in FIGS. **1** and **2**). The first paper dust removing roller **9***b* transports the paper **3** pinched

between the first transportation roller **9***a* and the first paper dust removing roller **9***b* while removing paper dust from the paper **3**.

As shown in FIG. **2**, the first sponge member **9***c* is composed of a material such as urethane foam that easily charges the first paper dust removing roller **9***b*. The first sponge member **9***c* is positioned beneath the first paper dust removing roller **9***b* and is pressed against the first paper dust removing roller **9***b*, so as to be able to scrape off paper dust at a scraping position **9***c***1**. The scraping position **9***c***1** contacts a portion of the first paper dust removing roller **9***b* that is a position at a lower side and an opposite side (farther side) from the first transportation path **43**. Thus, the first sponge member **9***c* can scrape off paper dust adhering to the first paper dust removing roller **9***b*. The first sponge member **9***c* also performs frictional charging of the surface of the roller **9***g* of the first paper dust removing roller **9***b* by rubbing against the first paper dust removing roller **9***b*. As shown in FIG. **3**(*c*), the width of the first sponge member **9***c* is slightly greater than the width of the roller **9***g* of the first paper dust removing roller **9***b*.

The second transportation section **10** is disposed downstream in the paper transportation direction with respect to the first transportation section **9** above the first transportation section **9**. The second transportation section **10** is located downstream of the junction position M**1** of the first transportation path **43** and the downstream end of the retransportation path **53**. Further, the second transportation section **10** is located slightly downstream of the junction position M**2** of the first transportation path **43** and the second transportation path **44**. The second transportation section **10** includes a second transportation roller **10***a* that transports the paper **3**, the second paper dust removing roller **10***b* located so as to confront the same surface as the surface confronting a multipurpose separation pad **15***b* described later, and a second sponge member **10***c* below the second paper dust removing roller **10***b*.

The second transportation roller **10***a* confronts the transportation path **46** from the outer side. The second transportation roller **10***a* has a metallic roller shaft **10***d* covered with a rubber roller be. The second transportation roller **10***a* is rotatable in the direction indicated by the arrow (counterclockwise direction in FIGS. **1** and **2**) by the power transmitted from a motor (not shown).

The second paper dust removing roller **10***b* confronts the transportation path **46** from the inner side. The second paper dust removing roller **10***b* has a metallic roller shaft **10***f* covered with the resin roller **10***g* whose surface is easily charged, such as a roller of fluororesin or a roller with a fluororesin coated surface. As shown in FIG. **3**(*c*), the second paper dust removing roller **10***b* is positioned in an approximately center position with respect to the second transportation roller **10***a*, such that the second paper dust removing roller **10***b* overlaps the pickup roller **12***a* and the separation roller **12***b* in the paper transportation direction. Accordingly, the second paper dust removing roller **10***b* can contact the surface of the paper **3** that has contacted the pickup roller **12***a* and the separation roller **12***b* (the surface opposite to the image formation surface). More specifically, the second paper dust removing roller **10***b* can contact a part that has contacted the pickup roller **12***a* and the separation roller **12***b* (the approximately center part). As described above, the width of the roller **10***g* of the second paper dust removing roller **10***b* is identical to the width of the roller **9***g* of the first paper dust removing roller **9***b*, but smaller than the width of the roller **11***g* of the third paper dust removing roller **11***b* described later, and slightly greater than the width of the pickup roller **12***a* and the separation roller **12***b*.

The second paper dust removing roller **10***b* is driven by the second transportation roller **10***a*. The second paper dust removing roller **10***b* is rotatable in the direction indicated by the arrow, that is, the same direction as the paper transportation direction in the part confronting the transportation path **46** (clockwise direction in FIGS. **1** and **2**). The second paper dust removing roller **10***b* transports the paper **3** pinched between the second transportation roller **10***a* and the second paper dust removing roller **10***b* while removing paper dust from the paper **3**.

The second sponge member **10***c* is made of a material that easily charges the second paper dust removing roller **10***b*, such as urethane foam. As shown in FIG. **2**, the second sponge member **10***c* is positioned beneath the second paper dust removing roller **10***b*. The second sponge member **10***c* is pressed against the second paper dust removing roller **10***b*, so as to be able to scrape off paper dust on a lower side of the second paper dust removing roller **10***b* that is opposite from the transportation path **46**. Thus, the second sponge member **10***c* can scrape off paper dust adhering to the second paper dust removing roller **10***b*. The second sponge member **10***c* also performs frictional charging of the surface of the roller **10***g* of the second paper dust removing roller **10***b* by rubbing against the second paper dust removing roller **10***b*. As shown in FIG. **3**(*c*), the width of the second sponge member **10***c* is slightly greater than the width of the roller **10***g* of the second paper dust removing roller **10***b*.

As shown in FIG. **2**, the third transportation section **11** is disposed downstream of the second transportation section **10** in the transportation path **46**. The third transportation section **11** is located in the vicinity of the second transportation section **10**. The third transportation section **11** includes a third transportation roller **11***a* that transports the paper **3**, the third paper dust removing roller **11***b* disposed to sandwich the transportation path **46** and to confront the third transportation roller **11***a*, and a third sponge member **11***c* above the third paper dust removing roller **11***b*.

The third transportation roller **11***a* confronts the transportation path **46** from the inner side. The third transportation roller **11***a* has a metallic roller shaft **11***d* covered with a rubber roller **11***e*. The third transportation roller **11***a* is rotatable in the direction indicated by the arrow (clockwise direction in FIGS. **1** and **2**) by the power transmitted from a motor (not shown).

The third paper dust removing roller **11***b* confronts the transportation path **46** from the outer side. The third paper dust removing roller **11***b* has a metallic roller shaft **11***f* covered with the resin roller **11***g* whose surface is easily charged, such as a roller of fluororesin or a roller with a fluororesin coated surface. As shown in FIG. **3**(*b*), with the third paper dust removing roller **11***b*, the width of the roller **11***g* is slightly greater than the width A of the paper **3**, so as to be contactable with the entire surface of the paper **3**. In addition, the third paper dust removing roller **11***b* contacts the entirety of the surface that has contacted the pad member **13***b* (the image formation surface that will contact the photosensitive drum **23**).

As shown in FIG. **2**, the third paper dust removing roller **11***b* is rotatable in the direction indicated by the arrow, that is, the same direction as the paper transportation direction in the part confronting the transportation path **46** (counterclockwise direction in FIGS. **1** and **2**). The third paper dust removing roller **11***b* transports the paper **3** pinched between

the third transportation roller **11***a* and the third paper dust removing roller **11***b* while removing paper dust from the paper **3**.

The third sponge member **11***c* is composed of a material that easily charges the third paper dust removing roller **11***b*, such as urethane foam. The third sponge member **11***c* is positioned above the third paper dust removing roller **11***b*. The third sponge member **11***c* is pressed against the third paper dust removing roller **11***b*, so as to scrape off paper dust at an upper side of the third paper dust removing roller **11***b*, which is an opposite side from the transportation path **46**. Thus, the third sponge member **11***c* can scrape off paper dust adhering to the third paper dust removing roller **11***b*. The third sponge member **11***c* also performs frictional charging of the surface of the roller **11***g* of the third paper dust removing roller **11***b* by rubbing against the third paper dust removing roller **11***b*. As shown in FIG. **3**(*b*), the width of the third sponge member **11***c* is slightly greater than the width of the third paper dust removing roller **11***b*.

As shown in FIGS. **2** and **4**, the paper dust transportation section **60** includes a receiving surface **61** and an auger member **62**. The receiving surface **61** receives paper dust scraped by the third sponge member **11***c*. The auger member **62** has an approximately cylindrical shape and transports the paper dust to the storage tank **71**. The paper dust transportation section **60** is constituted as a unit that can be inserted into and removed from the laser printer **1**.

The receiving surface **61** is formed into a curved concave shape for receiving the auger member **62**. The receiving surface **61** is slightly wider than the width of the third paper dust removing roller **11***b*.

As shown in FIG. **4**, the auger member **62** includes a shaft **63**, and a first spiral member **64** and a second spiral member **65** both formed in a spiral shape around the shaft **63**.

The first spiral member **64** is formed along the axial direction on an approximately half portion of the shaft **63**. The first spiral member **64** transports paper dust in one s direction (the direction indicated by arrow X) along the axial direction of the third paper dust removing roller **11***b* through rotation of the shaft **63**. The second spiral member **65** is formed along the axial direction on the other approximately half portion of the shaft **63** on the side opposite to the side on which the first spiral member **64** is formed. The second spiral member **65** transports paper dust in the other direction. (the direction indicated by arrow Y) along the axial direction of the third paper dust removing roller **11***b* through rotation of the shaft **63**.

With the above-described construction, paper dust received on the receiving surface **61** is transported to both ends of the axial direction (in the directions of the arrow X and the arrow Y) by the first spiral member **64** and the second spiral member **65**. The paper dust is dropped into and accumulated in the storage tank **71** located below the third transportation section **11**.

As shown in FIG. **1**, in the laser printer **1**, the reverse transportation path **41**, the retransportation path **53**, the first transportation path **43**, and the paper output path **42** jointly form a closed path for supplying the image forming section **5** with the paper **3** that has passed through the image forming section **5** with front and back sides thereof reversed. In other words, the reverse transportation path **41** forms a part of the closed path. The storage tank **71** is located within the closed path. An opening of the storage tank **71** is located below both the second paper dust removing roller **10***b* and the third paper dust removing roller **11***b*. Accordingly, the storage tank **71** can receive both paper dust removed by the second transportation section **10** and paper dust removed by the third transportation section **11**.

In the laser printer **1**, the paper **3** stacked in a pile in the paper feed tray **6** is separated and fed one sheet at a time by the cooperative action of the separation roller **12***b* and the separation pad **13**. At the time of the paper feeding, a large amount of paper dust is generated on the image formation surface due to friction with the separation pad **13**. However, when the paper **3** is first transported to the first transportation section **9**, and is pinched between the first transportation roller **9***a* and the first paper dust removing roller **9***b*, the image formation surface comes into contact with the roller **9***g* of the first paper dust removing roller **9***b*. The first paper dust removing roller **9***b* is slightly wider than the width of the separation pad **13**. Thus, paper dust generated on the paper **3** due to friction with the separation pad **13** is scraped off and electrostatically adsorbed by the roller **9***g* of the first paper dust removing roller **9***b*, because the paper dust generated on the paper **3** has a width approximately equal to the width of the pad s member **13***b* and because the width of the resin roller **9***g* is greater than the width B of the pad member **13***b*. Then, when the paper dust adhering to the roller **9***g* of the first paper dust removing roller **9***b* next confronts the first sponge member **9***c* through the rotation of the first paper dust removing roller **9***b*, the paper dust is scraped off by the first sponge member **9***c*, and falls into and is accumulated in a storage tank **72**.

A large amount of paper dust is also generated on the opposite surface that is opposite to the image formation surface due to friction with the pickup roller **12***a* and the separation roller **12***b* during the paper feeding. However, when the paper **3** is transported to the second transportation section **10**, and pinched between the second transportation roller **10***a* and the second paper dust removing roller **10***b*, the opposite surface comes into contact with the roller **10***g* of the second paper dust removing roller **10***b*. The second paper dust removing roller **10***b* is slightly wider than the width of the pickup roller **12***a* and the separation roller **12***b*. Thus, paper dust generated on the paper **3** due to friction with the pickup roller **12***a* and the separation roller **12***b* is scraped off and electrostatically adsorbed by the roller **10***g* of the second paper dust removing roller **10***b*, because the paper dust generated on the paper **3** has a width approximately equal to the width of the pickup roller **12***a* and the separation roller **12***b* and because the width of the roller **10***g* is greater than the width of the pickup roller **12***a* and the separation roller **12***b*. Then, when the paper dust adhering to the roller **10***g* of the second paper dust removing roller **10***b* next confronts the second sponge member **10***c* through the rotation of the second paper dust removing roller **10***b*, the paper dust is scraped off by the second sponge member **10***c*, and falls into and is accumulated in the storage tank **71**.

Then, when the paper **3** is transported to the third transportation section **11**, and pinched between the third transportation roller **11***a* and the third paper dust removing roller **11***b*, the image formation surface comes into contact with the roller **11***g* of the third paper dust removing roller **11***b*. At this time, since the third paper dust removing roller **11***b* is slightly wider than the width of the paper **3**, paper dust originally generated on the entirety of the paper **3** during cutting of the paper **3** and so forth, and paper dust remaining after removal by the first paper dust removing roller **9***b*, is scraped off and electrostatically adsorbed by the roller **11***g* of the third paper dust removing roller **11***b*. Then, when the paper dust adhering to the roller **11***g* of the third paper dust removing roller **11***b* next confronts the third sponge member **11***c* through the rotation of the third paper dust removing

roller **11***b*, the paper dust is scraped off by the third sponge member **11***c*. The scraped-off paper dust is received by the receiving surface **61**, and then, through the rotation of the auger member **62**, is transported to through-holes **66** at both ends of the axial direction (in the directions of the arrow X and the arrow Y), and is dropped into and accumulated in the storage tank **71** located below the third transportation section **11**.

Thus, in the laser printer **1**, before the paper **3** fed by the paper feed mechanism section **7** reaches the image forming section **5**, part of paper dust corresponding to the width B of the pad member **13***b* is removed by the first paper dust removing roller **9***b*, part of paper dust corresponding to the width of the pickup roller **12***a* and the separation roller **12***b* is removed by the second paper dust removing roller **10***b*, and part of the paper dust corresponding to the width A of the paper **3** is removed by the third paper dust removing roller **11***b*.

Accordingly, a greater amount of paper dust generated by friction with the pad member **13***b* is removed by the first paper dust removing roller **9***b* and the third paper dust removing roller **11***b*, and a smaller amount of paper dust originally generated on the entirety of the paper **3** during cutting of the paper **3** and so forth is removed by the third paper dust removing roller **11***b*. Also, paper dust generated by friction between the pickup roller **12***a* and the separation roller **12***b* is removed by the second paper dust removing roller **10***b*. As a result, the first transportation section **9**, the second transportation section **10**, and the third transportation section **11** can remove paper dust generated on the image formation surface due to friction with the pad member **13***b* and paper dust originally generated, in a well-balanced manner, and can achieve uniform paper dust removal with little unevenness of removal. Moreover, the first transportation section **9**, the second transportation section **10**, and the third transportation section **11** also can remove paper dust generated due to friction between the pickup roller **12***a* and the separation roller **12***b* on the opposite surface to the image formation surface, and can prevent dispersion of paper dust inside the laser printer **1**. Thus, the laser printer **1** can prevent contamination of the image forming section **5** due to paper dust effectively, and can form high-quality images.

As the third paper dust removing roller **11***b* is located downstream of the first paper dust removing roller **9***b* in the paper transportation direction, a greater amount of paper dust produced by friction with the pad member **13***b* is first removed by the first paper dust removing roller **9***b*, after which a smaller amount of paper dust originally produced over the entire paper **3** during cutting of the paper **3** and so forth is additionally removed by the third paper dust removing roller **11***b*. Thus, the laser printer **1** can achieve efficient paper dust removal based on differences in the amount of paper dust, enabling more uniform paper dust removal.

The third paper dust removing roller **11***b* has a width greater than the width of the paper **3**, while the first paper dust removing roller **9***b* has a width greater than the width of the separation pad. **13** and less than the width of the third paper dust removing roller **11***b*. Therefore, the first paper dust removing roller **9***b* is not wider than necessary, allowing costs to be reduced while enabling paper dust to be removed in a well-balanced manner.

As described above, in the laser printer **1**, the first paper dust removing roller **9***b* is located at a predetermined distance from the separation roller **12***b*, and is located downstream in the paper transportation direction, so as not to come into contact with the separation roller **12***b*.

If the first paper dust removing roller **9***b* is in contact with the separation roller **12***b*, for example, then the paper **3** to be fed next is pulled out slightly following the paper **3** fed before, due to friction between the separation roller **12***b* and the paper **3** fed before. In this case, if a front-end portion of the paper **3** was held between the separation roller **12***b* and the first paper dust removing roller **9***b*, and the laser printer **1** was stopped in that state, the front-end portion of the paper **3** pinched between the separation roller **12***b* and the first paper dust removing roller **9***b* might tend to curl. In such a case, when the paper **3** was next supplied, a paper jam may occur or an imperfect image may be produced on the curled front-end portion.

However, because the first paper dust removing roller **9***b* is located so as not to come into contact with the separation roller **12***b*, even if the paper **3** to be fed next should be pulled out slightly following the previously fed paper **3**, the paper **3** will not be held between the separation roller **12***b* and the first paper dust removing roller **9***b*. Thus, curling of the front-end portion of the paper **3** can be prevented. Accordingly, the laser printer **1** can achieve satisfactory paper feeding at all times while also performing good paper dust removal.

In the first transportation section **9**, the second transportation section **10**, and the third transportation section **11**, because the first sponge member **9***c* for scraping off paper dust adhering to the first paper dust removing roller **9***b* is provided to confront the first paper dust removing roller **9***b*, the second sponge member **10***c* for scraping off paper dust adhering to the second paper dust removing roller **10***b* is provided to confront the second paper dust removing roller **10***b*, and the third sponge member **11***c* for scraping off paper dust adhering to the third paper dust removing roller **11***b* is provided to confront the third paper dust removing roller **11***b*, paper dust adhering to the first paper dust removing roller **9***b*, the second paper dust removing roller **10***b*, and the third paper dust removing **10** roller **11***b* are scraped off by the first sponge member **9***c*, the second sponge member **10***c*, and the third sponge member **11***c*, respectively. Thus, the paper dust removal capability of the first paper dust removing roller **9***b*, the second paper dust removing roller **10***b*, and the third paper dust removing roller **11***b* can be maintained, and good paper dust removal over a long period can be achieved.

As described above, the widths of the first sponge member **9***c*, the second sponge member **10***c*, and the third sponge member **11***c* are formed so as to be slightly greater than the widths of the first paper dust removing roller **9***b*, the second paper dust removing roller **10***b*, and the third paper dust removing roller **11***b*, respectively. Accordingly, paper dust can be scraped satisfactorily even if paper dust on the paper **3** spreads slightly in the width direction due to contact with the first paper dust removing roller **9***b*, the second paper dust removing roller **10***b*, and the third paper dust removing roller **11***b*.

In the laser printer **1**, the paper **3** fed by the paper feed mechanism section **7** is first pinched between the first paper dust removing roller **9***b* and the first transportation roller **9***a* and transported while paper dust is removed, then pinched between the second paper dust removing roller **10***b* and the second transportation roller **10***a* and transported while paper dust is removed, and then further pinched between the third paper dust removing roller **11***b* and the third transportation roller **11***a* and transported while paper dust is removed. The paper **3** can be transported smoothly to the image forming section **5** while paper dust can be removed in a well-balanced manner.

The third paper dust removing roller **11***b* is not driven by the third transportation roller **11***a*, but instead motive power is input to the third paper dust removing roller **11***b* from a separate motor (not shown) via an input gear **11***h*, enabling the third paper dust removing roller **11***b* to be driven by itself. Thus, even if torque load due to contact with the paper **3** and the third sponge member **11***c* is applied to the entirety of the roller **11***g* of the third paper dust removing roller **11***b*, the third paper dust removing roller **11***b* can be rotated smoothly by its own drive force, and good paper dust removal and transportation can be achieved.

The laser printer **1** is provided with the reverse mechanism **37**, and the first transportation section **9** is located upstream of the junction position M**1** of the retransportation path **53** and the first transportation path **43**, while the second transportation section **10** is located downstream of the junction position M**1**, and the third transportation section **11** is located downstream of the second transportation section **10**.

With the above-described construction, since the first paper dust removing roller **9***b* is located upstream of the junction position M**1**, the first paper dust removing roller **9***b* comes into contact with only the paper **3** fed from the paper feed mechanism section **7**. On the other hand, since the second paper dust removing roller **10***b* and the third paper dust removing roller **11***b* are located downstream of the junction position M**1**, the second paper dust removing roller **10***b* and the third paper dust removing roller **11***b* come into contact with both the paper **3** fed from the paper feed mechanism section **7** and the paper **3** retransported from the retransportation path **53**.

Thus, the first paper dust removing roller **9***b* removes only a greater amount of paper dust generated on paper fed from the paper feed mechanism section **7** by friction with the pad member **13***b*, while the second paper dust removing roller **10***b* removes paper dust generated by friction between the pickup roller **12***a* and the separation roller **12***b* and paper dust on the paper **3** retransported from the retransportation path **53**. In addition, the third paper dust removing roller **11***b* removes paper dust on the paper **3** fed from the paper feed mechanism section **7** from which the majority of a greater amount of paper dust generated by friction with the pad member **13***b* has already been removed by the first paper dust removing roller **9***b*. The third paper dust removing roller **11***b* also removes paper dust of the paper **3** retransported from the retransportation path **53**. Thus, paper dust can be removed effectively according to the amount of paper dust adhering to the paper **3**.

The laser printer **1** in the present embodiment is provided with a single first transportation section **9**, a single second transportation section **10**, and a single third transportation section **11**. However, a plurality of each of the first transportation section **9**, the second transportation section **10**, and the third transportation section **11** may be provided. Alternatively, a plurality of any one of the first transportation section **9**, the second transportation section **10**, or the third transportation section **11** may be provided.

The first transportation section **9** provided with the first paper dust removing roller **9***b*, the second transportation section **10** provided with the second paper dust removing roller **10***b*, and the third transportation section **11** provided with the third paper dust removing roller **11***b* are located in this order in the paper transportation downstream direction, but the order of the transportation sections **9**, **10**, and **11** may be changed. For example, the second transportation section **10**, the third transportation section **11**, and the first transportation section **9** may be disposed in this order in the paper transportation downstream direction.

In this case, because paper dust on the paper **3** spreads slightly in the paper width direction due to contact with the third paper dust removing roller **11***b*, it is desirable that the widths of the first paper dust removing roller **9***b* and the first sponge member **9***c* be greater than the widths in the above-described embodiemnt.

The locations of drive rollers and driven (follow) rollers of the first transportation section **9**, the second transportation section **10**, and the third transportation section **11** may also be reversed in terms of which is on the inner side and which is on the outer side of the closed path as compared with the above-described embodiment.

As shown in FIG. **1**, the laser printer **1** is provided with a multipurpose tray **14** on which the paper **3** of an arbitrary size is stacked, and a multipurpose paper feed mechanism section **15** for feeding the paper **3** stacked in the multipurpose tray **14**.

As shown in FIG. **2**, the multipurpose paper feed mechanism section **15** includes a multipurpose paper feed roller **15***a* and the multipurpose separation pad **15***b* opposing the multipurpose paper feed roller **15***a*. The multipurpose paper feed mechanism section **15** is disposed at a position along the second transportation path **44**. The multipurpose paper feed mechanism section **15** picks up the paper **3** by the multipurpose paper feed roller **15***a*, and separates the paper **3** by contacting the paper **3**, so that one sheet of the paper **3** is transported downstream in the second transportation path **44**.

The multipurpose separation pad **15***b* includes a supporting frame **15***c*, a multipurpose pad member **15***d*, and a spring **15***e*.

The supporting frame **15***c* has a one end portion **15***c***1** and an other end portion **15***c***2**, both of which are formed integrally. The one end portion **15***c***1** is flat plate-shaped. The one end portion **15***c***1** is disposed below the multipurpose paper feed roller **15***a* and confronts the multipurpose paper feed roller **15***a*. The other end portion **15***c***2** has an L-shaped cross section, and is pivotally supported to the main casing **2** by a support shaft **15***c***3**, such that the supporting frame **15***c* can be pivotally moved about the support shaft **15***c***3**. The multipurpose pad member **15***d* is inset in a concave portion on a side of the one end portion **15***c***1** that confronts the multipurpose paper feed roller **15***a*. The spring **15***e* is disposed on the other side. The spring **15***e* urges the one end portion **15***c***1** such that the multipurpose pad member **15***d* is pressed against the multipurpose paper feed roller **15***a*.

The multipurpose pad member **15***d* has an approximately rectangular plate shape, includes a urethane rubber or similar elastic member, and is formed so that the width of the multipurpose separation pad **15***b* is smaller than the width of the paper **3**. In other words, the multipurpose separation pad **15***b* has a width that provides contact with only the widthwise center part of the paper **3** for feeding the paper **3**.

Then the topmost paper **3** stacked in the multipurpose tray **14** is pinched between the multipurpose paper feed roller **15***a* and the multipurpose separation pad **15***b* by the rotation of the multipurpose paper feed roller **15***a*, and is separated and fed one sheet at a time by the cooperative action of the multipurpose paper feed roller **15***a* and the multipurpose separation pad **15***b*.

The paper **3** fed from the multipurpose tray **14** passes through the second transportation path **44**, and is transported to the second transportation section **10**. At this time, as described above, the paper **3** is transported by being pinched between the second transportation roller **10***a* and the second

paper dust removing roller **10***b*, and the surface opposite to the image formation surface comes into contact with the roller **10***g* of the second paper dust removing roller **10***b*. At this time, since the second paper dust removing roller **10***b* is slightly wider than the width of the multipurpose separation pad **15***b*, paper dust generated with a width approximately equal to the width of the multipurpose separation pad **15***b* on the paper **3** due to friction with the multipurpose separation pad **15***b* is scraped off and electrostatically adsorbed by the roller **10***g*. Then, when the paper dust adhering to the roller **10***g* next confronts the second sponge member **10***c* through the rotation of the second paper dust removing roller **10***b*, the paper dust is scraped off by the second sponge member **10***c*, and falls into and is accumulated in the storage tank **71**.

As described above, paper dust generated with a width approximately equal to the width of the multipurpose separation pad **15***b* on the paper **3** due to friction with the multipurpose separation pad **15***b* is removed satisfactorily from the surface of the paper **3** in the second transportation section **10**.

Subsequently, the paper **3** passes further through the transportation path **46**, and is transported to the third transportation section **11**. At this time, as described above, paper dust originally generated on the entirety of the paper **3** during cutting of the paper **3** and so forth is scraped off and electrostatically adsorbed by the roller **11***g* of the third paper dust removing roller **11***b*. Then, when the paper dust adhering to the roller **11***g* next confronts the third sponge member **11***c* through the rotation of the third paper dust removing roller **11***b*, the paper dust is scraped off by the third sponge member **11***c*. The scraped-off paper dust is received by the receiving surface **61**, and then, through the rotation of the auger member **62** (FIG. **4**), is transported to the both ends of the axial direction (in the directions of the arrow X and the arrow Y) of the third paper dust removing roller **11***b* by the first spiral member **64** and the second spiral member **65**, and is dropped into and accumulated in the storage tank **71** located below the third transportation section **11**.

Accordingly, paper dust originally generated on the entirety of the paper **3** during cutting of the paper **3** and so forth is removed satisfactorily from the surface of the paper **3** in the third transportation section **11**.

According to the present embodiment, paper dust can be removed across the entire width of the paper **3** whichever transportation path the paper **3** passes through. Therefore, image quality degradation caused by paper dust on the paper **3** is less likely to occur. Also, as paper dust can be removed from parts in contact with the separation pad **13** whichever transportation path the paper **3** passes through, image quality degradation caused by paper dust on the paper **3** is less likely to occur.

Moreover, as paper dust adhering to the paper **3** that has passed through the reverse transportation path **41** can be removed, when images are formed on both sides, quality degradation caused by paper dust on the paper **3** is less likely to occur for both side.

Further, the paper **3** fed from the paper supply cassette **4** passes through the first transportation section **9** provided with the first paper dust removing roller **9***b*, the second transportation section **10** provided with the second paper dust removing roller **10***b*, and the third transportation section **11** provided with the third paper dust removing roller **11***b*, along the first transportation path **43**. Thus, the paper dust on the paper **3** passing through the first transportation path **43** is thoroughly removed, and quality degradation of images caused by paper dust on the paper **3** is less likely to occur. On the other hand, the paper **3** fed from the multipurpose tray **14** passes through the second transportation section **10** provided with the second paper dust removing roller **10***b* and the third transportation section **11** provided with the third paper dust removing roller **11***b*, along the second transportation path **44**. Thus, the paper dust on the paper **3** passing through the second transportation path **44** is thoroughly removed, and quality degradation caused by the paper dust is less likely to occur.

Further, the storage tank **71** that holds paper dust is disposed inside the closed path that is partly formed by the reverse transportation path **41**, and is located below the second transportation section **10** and the third transportation section **11**. Thus, because it is not necessary to provide two separate storage tanks for the second transportation section **10** and the third transportation section **11**, a space can be used effectively, and the laser printer **1** can be made smaller. In addition, costs can be reduced through a reduction in the number of component parts.

In the above-described embodiment, the storage tank **71** is located below the second transportation section **10** and the third transportation section **11**, and can hold dust scraped off and dropped by both the second paper dust removing roller **10***b* and the third paper dust removing roller **11***b*. However, tanks may be provided separately for the second transportation section **10** and the third transportation section **11**.

While the invention has been described in detail with reference to the specific embodiment thereof, it would be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention.

For example, the above-described embodiment relates to a laser printer. However, the present invention is not limited to a laser printer and can also be applied to different types of printers such as an ink-jet type printer, an image reading device, or another device having the same kind of transportation paths as the above-described embodiment.

Further, in the above-described embodiment, the laser printer **1** has a reverse transportation path. However, the laser printer may be a printer that does not have a reverse transportation path.

What is claimed is:

1. An image forming device comprising:

an image forming section forming an image on an image formation surface of a recording medium, the recording medium having a width in a widthwise direction orthogonal to a recording-medium transportation direction;

a plurality of recording-medium supply units each supplying the image forming section with the recoding medium;

a transportation guide forming a plurality of transportation paths, each transportation path connecting a corresponding one of the plurality of recording-medium supply units to the image forming section, the recording medium being transported from each recording-medium supply unit to the image forming section in the recording-medium transportation direction, each of the plurality of transportation paths joining together to provide a single main transportation path before reaching the image forming section, the single main transportation path being a path through which the recording mediums supplied from all of the plurality of recording-medium supply units are transported;

a full-width cleaning member disposed in the single main transportation path, the full-width cleaning member being contactable with the image formation surface of the recording medium, the full-width cleaning member

having a full-width cleaning portion for removing foreign matter adhering to the image formation surface of the recording medium, the full-width cleaning portion having a first width greater than the width of the recording medium in the widthwise direction;

a plurality of recording-medium separating members each disposed at a position, in each of the plurality of transportation paths, between a corresponding recording-medium supply unit and the full-width cleaning member, each recording-medium separating member being contactable with one surface of the recording medium, thereby separating only one sheet of the recording medium to be transported downstream, each recording-medium separating member having a second width in the widthwise direction smaller than the width of the recording medium; and

at least one partial cleaning member provided for each recording-medium separating member, the at least one partial cleaning member being disposed at a position, in a corresponding transportation path, between a corresponding recording-medium separating member and the image forming section, each partial cleaning member being contactable with the one surface of the recording medium, each partial cleaning member having a partial cleaning portion for removing foreign matter adhering to the one surface of the recording medium, the partial cleaning portion having a third width greater than the second width of the corresponding recording-medium separating member.

2. The image forming device as claimed in claim **1**, further comprising a reverse guide that forms a reverse transportation path for supplying the image forming section with the recording medium that has passed through the image forming section with front and back sides thereof reversed:

wherein the plurality of transportation paths includes a first transportation path and a second transportation path;

wherein the reverse transportation path joins with the first transportation path at a first junction position;

wherein the first transportation path and the second transportation path join with each other at a second junction position to provide the single main transportation path, the second junction position being positioned downstream of the first junction position; and

wherein the full-width cleaning member is positioned in the single main transportation path between the second junction position and the image forming section.

3. The image forming device as claimed in claim **1**, further comprising a reverse guide that forms a reverse transportation path for supplying the image forming section with the recording medium that has passed through the image forming section with front and back sides thereof reversed;

wherein the reverse transportation path joins with one of the plurality of transportation paths at a position upstream of both the full-width cleaning member and at least the partial cleaning member located nearest to the full-width cleaning member.

4. The image forming device as claimed in claim **3**, further comprising a storage tank storing the foreign matter removed from the recording medium by the full-width cleaning member;

wherein the reverse transportation path forms a part of a closed path for supplying the image forming section with the recording medium that has passed through the image forming section with front and back sides thereof reversed; and

wherein the storage tank is disposed inside the closed path.

5. The image forming device as claimed in claim **1**, further comprising a rotation member provided for each recording-medium separating member, the rotation member having a surface with a coefficient of friction that is higher than a coefficient of friction of the recording-medium separating member, the rotation member transporting the recording medium downstream by pinching the recording medium in cooperation with the recording-medium separating member.

6. The image forming device as claimed in claim **1**, wherein the plurality of recording-medium supply units includes a recording-medium feed tray and a recording-medium supply cassette, the recording-medium supply cassette being capable of accommodating a plurality of recording media in a stacked form.

7. The image forming device as claimed in claim **1**, wherein the plurality of transportation paths includes a first transportation path and a second transportation path, the first and second transportation paths joining with each other at a predetermined junction position to provide the single main transportation path;

wherein, in the first transportation path, the at least one partial cleaning member is disposed upstream of the predetermined junction position; and

wherein, in the second transportation path, the at least one partial cleaning member is disposed downstream of the predetermined junction position.

8. The image forming device as claimed in claim **7**, wherein the recording medium has a first surface and a second surface opposite to the first surface;

wherein the at least one partial cleaning member provided in the first transportation path is disposed to confront the first surface; and

wherein the at least one partial cleaning member provided in the second transportation path is disposed to confront the second surface.

9. The image forming device as claimed in claim **7**, wherein the plurality of recording-medium supply units includes a recording-medium feed tray and a recording-medium supply cassette, the recording-medium supply cassette being capable of accommodating a plurality of recording media in a stacked form;

wherein the first transportation path connects the recording-medium supply cassette to the image forming section; and

wherein the second transportation path connects the recording-medium feed tray to the image forming section.

10. The image forming device as claimed in claim **1**, further comprising a storage tank storing the foreign matter removed from the recording medium by the full-width cleaning member.

11. The image forming device as claimed in claim **10**, wherein the storage tank stores both the foreign matter removed from the recording medium by the full-width cleaning member and the foreign matter removed from the recording medium by at least one of the partial cleaning members.

12. The image forming device as claimed in claim **1**, wherein the image forming section includes:

a light source emitting a light beam;

an image bearing member on which an electrostatic latent image is formed by the light beam emitted from the light source;

a developing section developing, with developer, the electrostatic latent image formed on the image bearing member and forming a developed image; and

a transfer section transferring the developed image formed on the image bearing member to the recording medium.

13. The image forming device as claimed in claim **1**, wherein the third width is smaller than the first width.

14. An image forming device comprising:

an image forming section forming an image on an image formation surface of a recording medium, the recording medium having a width in a widthwise direction orthogonal to a recording-medium transportation direction;

a plurality of recording-medium supply units each supplying the image forming section with the recoding medium;

a transportation guide forming a plurality of transportation paths, each transportation path connecting a corresponding one of the plurality of recording-medium supply units to the image forming section, the recording medium being transported from each recording-medium supply unit to the image forming section in the recording-medium transportation direction, each of the plurality of transportation paths joining together to provide a single main transportation path before reaching the image forming section;

a full-width cleaning member disposed in the single main transportation path at a position downstream from all of the plurality of recording-medium supply units, the full-width cleaning member being contactable with the image formation surface of the recording medium, the full-width cleaning member having a full-width cleaning portion for removing foreign matter adhering to the image formation surface of the recording medium, the full-width cleaning portion having a first width greater than the width of the recording medium in the widthwise direction;

a plurality of recording-medium separating members each disposed at a position, in each of the plurality of transportation paths, between a corresponding recording-medium supply unit and the full-width cleaning member, each recording-medium separating member being contactable with one surface of the recording medium, thereby separating only one sheet of the recording medium to be transported downstream, each recording-medium separating member having a second width in the widthwise direction smaller than the width of the recording medium; and

at least one partial cleaning member provided for each recording-medium separating member, the at least one partial cleaning member being disposed at a position, in a corresponding transportation path, between a corresponding recording-medium separating member and the image forming section, each partial cleaning member being contactable with the one surface of the recording medium, each partial cleaning member having a partial cleaning portion for removing foreign matter adhering to the one surface of the recording medium, the partial cleaning portion having a third width greater than the second width of the corresponding recording-medium separating member.

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